SOME ESTIMATES OF THE THICKNESS OF THE SEDIMENTARY ROCKS OF OHIO

T. M. HILLS
Ohio State University

Since the discovery of crystalline rock at a depth of 3,320 feet at Waverly[1] in 1911, and at Findlay,[1] at a depth of 2,770 feet, in 1912, deep wells have been drilled in many parts of Ohio. From their records, the following estimates are made of the thickness of the sedimentary rocks along the eastern and southern borders of the state.

The data used[2] have been taken from wells located along three lines, two of them running east-west, the other north-south. The first extends from Findlay through Cleveland eastward to the central part of Ashtabula County, the second from the city of Columbus east to northern Muskingum County, the third from Norwalk to Jefferson Township, Jackson County.

The two formations used as datum planes in the calculations are the Trenton and the Clinton. The tops of these formations are recognized with a reasonable degree of certainty by drillers. Unfortunately, the two wells mentioned above are the only ones that have passed through the Trenton rocks of the state. Therefore the distance from the top of the Trenton to the crystalline rocks must be taken from these wells and considered as constant for the area. The wells in the eastern and central parts of the state do not extend below the Clinton; therefore the depth from this formation to the Trenton, and to the crystalline rocks below, must be supplied from the known wells of other parts of the state. This assumes that the Trenton-to-crystalline-rock interval is constant over a wide area, and that the Clinton-to-Trenton interval varies at a uniform rate. These are both broad assumptions, but with the data available cannot be avoided.

[1] Condit, *Amer. Jour. Sci.*, Fourth Series, Vol. XXXVI, p. 123, August, 1913.

[2] Acknowledgments are due *The Ohio Geological Survey* for the use of its files of well data.

The northern line of wells.—At Findlay the interval between the crystalline rocks and the top of the Trenton formation is 1,605 feet. This will be considered as constant for northern Ohio.

At Lorain, the interval between the Clinton and the Trenton is 1,075 feet, at Cleveland 1,658 feet, an increase of 21 feet per mile to the eastward. If this continues to the state line sixty miles eastward, the interval would be 2,918 feet (1,658+1,260).

In Wayne Township, Ashtabula County, the Clinton formation is found 2,940 feet below sea level. Data from wells at Lorain, Avon, East Cleveland, Chester Township, Geauga County, Hartsgrove and Wayne townships, Ashtabula County, show an average, although not constant, decline of the surface of this formation of 22.7 feet per mile. If the eastward decline continues at the same rate to the state line, the surface of the formation should be about 3,172 feet below sea level at this point. Add to this figure the estimated distance between the top of the Clinton and the top of the Trenton, 2,918 feet, and the distance from the top of the Trenton to the crystalline rocks, 1,605 feet, and we have a total of 7,695 feet, the depth below sea level at which crystalline rocks should be found near the northeastern corner of Ohio. An addition of at least 1,000 feet should be made for the thickness of strata above sea level, giving a total estimate of some 8,700 feet of sedimentary rocks in this part of the state.

Central Ohio.—The wells extending from Columbus to north central Muskingum County are not on a straight line, but the departures to the north side are practically balanced by those to the south. It will be seen later that the variation in thickness of the sedimentary rocks along a north and south line is comparatively slight in short distances.

The Clinton occurs 186 feet below sea level in a well along the Mifflin Township line in the eastern part of the city of Columbus. From this well to one at Basil, the top of the Clinton declines at an average rate of 41 feet per mile. Eight other wells, some of them as far east as north central Muskingum County, show a decline ranging from 56 feet to 34.9 feet per mile, with an average of 46.6 feet. Using the last figure, the top of the Clinton should be 5,778 feet (=186+5,592) below sea level at Wheeling, 120 miles eastward.

At Waverly the top of the Clinton is 310 feet below sea level, and the top of the crystalline rocks, 2,730 feet. The interval between is 2,420 feet. If at Wheeling the interval is the same, the crystalline rocks would be found at 8,198 feet (=5,778+2,420). Add 1,000 feet for the strata above sea level, and the estimate is brought to 9,198 feet. This figure does not include the increase in the interval between the top of the Clinton and the top of the Trenton found along the northern part of the state, which was 21 feet per mile. Addition for such thickening would add 2,520 feet, bringing the total to 12,028 feet.

The north and south line of wells.—This row of wells is practically at right angles to the other two.

At Norwalk the Trenton was reached 1,945 feet below sea level. In Jefferson Township, Jackson County, it was found at 2,885 feet, a difference of 940 feet in 162 miles, a decline of 5.8 feet per mile. If this decline continues southward to the Ohio River, twenty-five miles farther, the Trenton would be found there 3,030 feet below sea level. The Trenton (top)-to-crystalline interval of 1,220 feet, found at Waverly, would place the bottom of the sedimentary rocks 4,250 feet below sea level. Add a thousand feet for strata above sea level, as in the previous cases, and we have 5,250 feet for the thickness of strata above the crystalline rocks at the Ohio River, near Ironton.

Summary.—From the northern line of wells the sedimentary strata of northeastern Ohio are estimated to be nearly 9,000 feet, from those of central Ohio to be over 12,000 feet in the eastern part of the state, and in southern Ohio to be more than 5,000 feet thick.

Wells along other lines give results of the same order of magnitude, the same assumptions concerning the interval between the top of the Trenton and the crystalline rocks being made. Since the post-Trenton strata thicken toward the Appalachian trough, either by the increase in the thickness of the formations themselves, or the introduction of new formations, it is reasonable to suppose that the pre-Trenton sediments do the same, so that the results obtained are probably underestimates rather than overestimates.

The presence of the Cincinnati Arch in the southwestern part of the state adds so many complicating features that it does not now seem advisable to attempt an estimate for this part of the state.